

**Bofors-Nobel PRP Group Response to U.S. EPA PZ-111A Phase 2  
Investigation Work Plan Comments Dated August 9, 2011**

Below are the Group's responses to U.S. EPA comments on the PZ-111A Phase 2 Investigation Work Plan. The comments are in italics, followed by the response in normal type. U.S. EPA's August 9<sup>th</sup> email stated that, "on behalf of the Performing Settling Defendants, EMI must ensure that the following requirements are implemented." The Group's response is provided below.

1. *Section 1--what was the concentration of toluene, and what well was it detected in, during the April 2011 interim sampling event?*

Figure 1 shows the concentrations of toluene in the April 2011 interim sampling, and where it was detected. Several groundwater wells behind the barrier wall were also sampled in April as part of the initial month of the treatment wetland investigation, and those results are also plotted on the map in Figure 1.

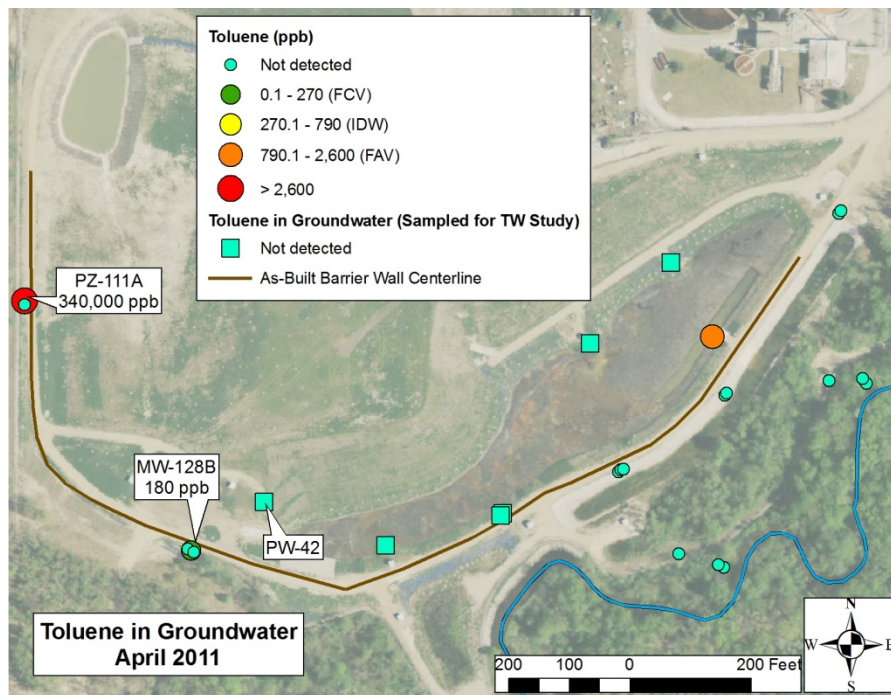


Figure 1. Toluene in groundwater in April 2011.

Figure 2 shows the screen intervals of the PZ-111, PZ-113 and MW-128 well clusters, and the PW-42 well. PZ-111A, PZ-113A, MW-128B and PW-42 are all screened across the same interval, around 600 ft msl, although PW-42 has a much longer screen.

August 17, 2011

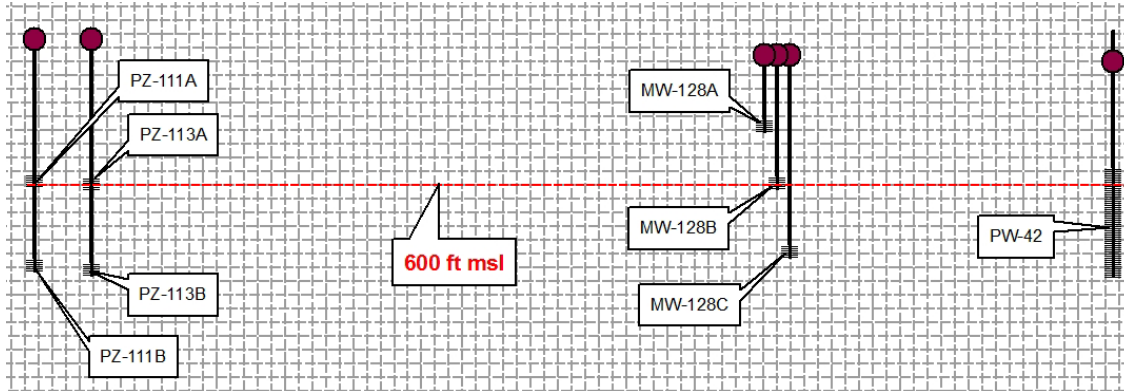


Figure 2. Screen intervals of wells in potential toluene flowpath.

Figure 3 presents the toluene detected in the groundwater in July 2011. A large increase in the toluene concentration in well MW-128B was detected. Toluene was also detected in MW-128C.

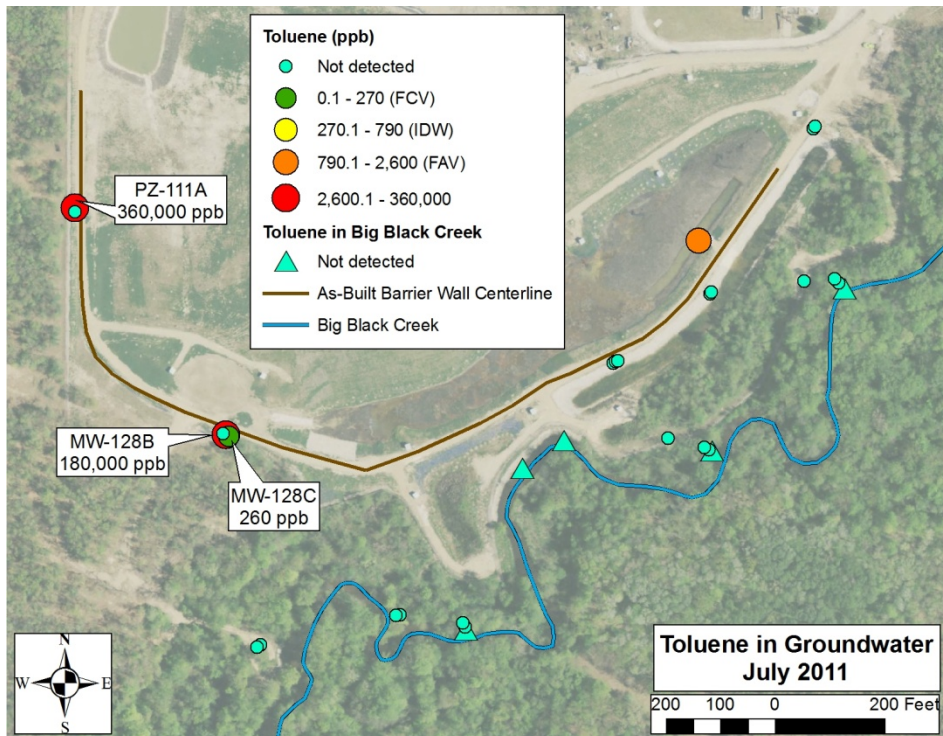


Figure 3. Toluene concentrations in July 2011.

Figures 4 through 7 show the time series graphs for toluene in wells PZ-111A, PZ-111B, MW-128B and MW-128C. Figure 5 shows that no toluene has been detected in PZ-111B since the start of this spike in PZ-111A. Monitoring well MW-128B was re-sampled on August 11, 2011, to confirm the result of 180,000 ppb.

In the following graphs, note that there have been several significant jumps in toluene concentration in wells over periods of from three to six months. Examples are: PZ-111A between March and June 2009 (0 to 200,000 ppb); PZ-111A between September 2010 and April 2011 (180,000 to 340,000 ppb); MW-128B between April and July 2011 (180 to 180,000 ppb). These jumps in concentrations are inconsistent with the expected characteristics of solute transport in porous media.

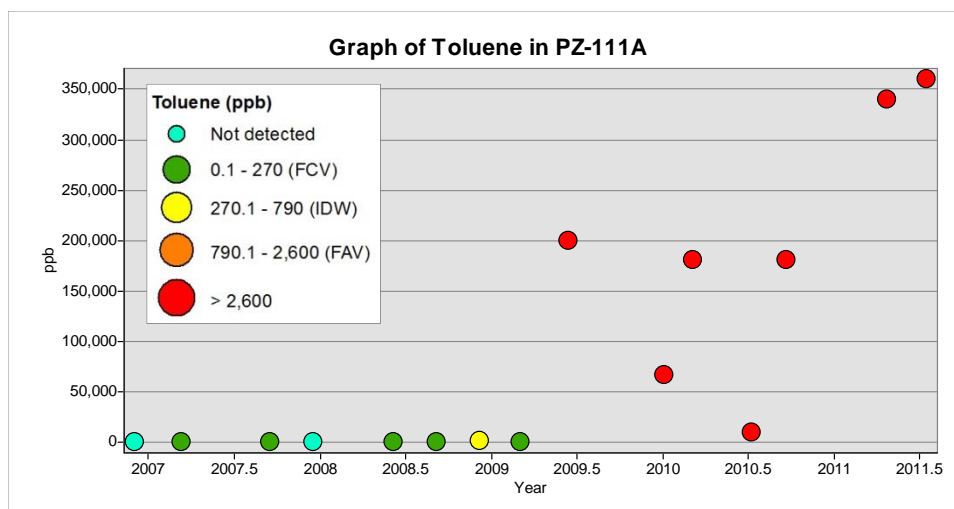


Figure 4. Time series of toluene in PZ-111A.

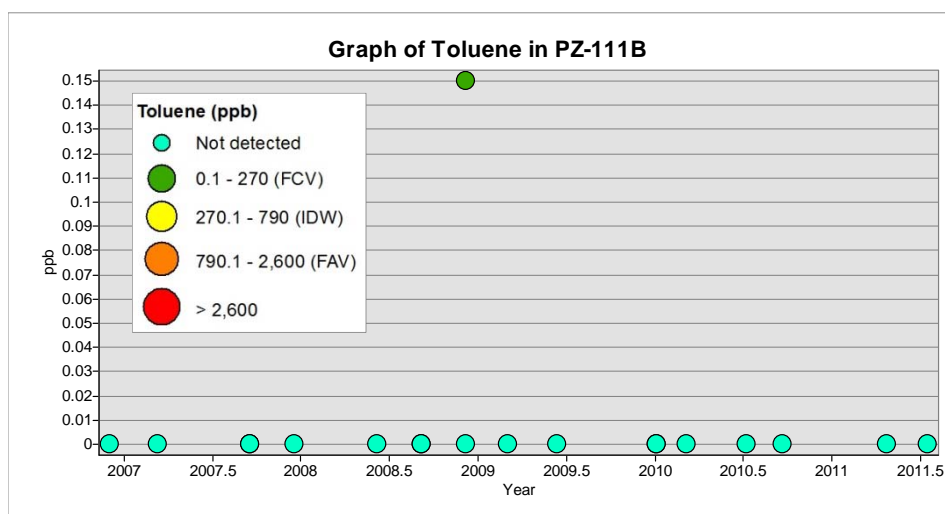


Figure 5. Time series of toluene in PZ-111B.

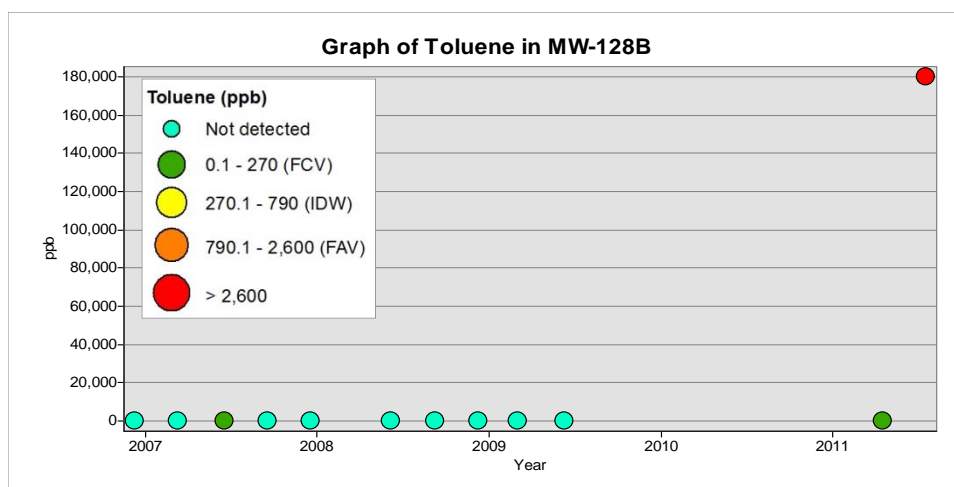


Figure 6. Time series of toluene in MW-128B.

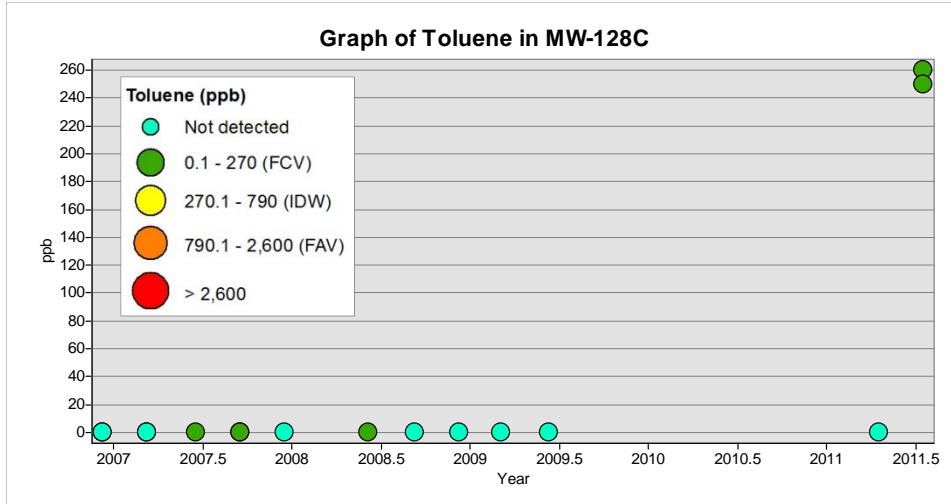


Figure 7. Time series of toluene in MW-128C.

2. *We may want to provide some coverage in this area.*

We propose additional MIP locations shown in Figure 8. Note that the MIP results will be reviewed daily to determine whether the edge of the toluene plume has been defined in any specific direction. Additional MIP locations will be added if necessary. If the material is moving due south, the additional MIPs will eventually intersect with the extensive network of multi-port wells installed by the MDEQ. It would be preferable to have the MDEQ's data prior to installations of multiple rings of MIPs to the south. The additional MIP locations shown in Figure 8 include locations adjacent to well clusters (MW-128, PZ-112 and MW-85) to determine the validity of the well clusters as toluene monitoring wells, and to verify that the toluene is moving along the wall between PZ-111A and MW-128B.

Also shown on Figure 8 are proposed additional Phase 2 sample locations in wells which are in the potential flow-path of the toluene, given its presence in MW-128B.



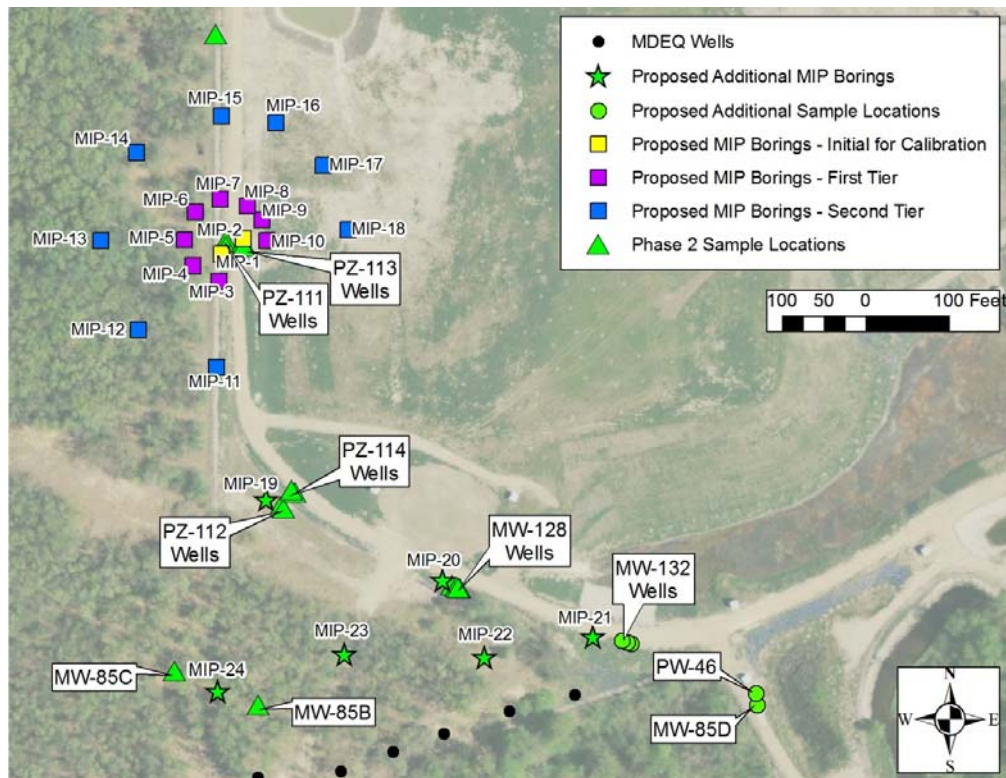


Figure 8. PZ-111A Phase 2 Investigation additional proposed MIP and sample locations.

The additional MIP borings shown in Figure 8 are proposed for the reasons detailed in Table 1.

Proposed Additional MIP	Reason for Location
MIP-19	To determine whether the screen intervals of wells PZ-112A and PZ-112B are appropriate to serve as sentinel wells, and also to determine whether the toluene is traveling along the barrier wall.
MIP-20	To verify the vertical distribution of toluene in this location.
MIP-21	To identify whether the toluene has moved toward the pumping well PW-46 and to determine whether the screen intervals in well cluster MW-132 are appropriate for any of these wells to be a meaningful sentinel.
MIP-22	This point is halfway between the barrier wall and the MDEQ wells, to determine whether the toluene is moving away from the barrier wall.
MIP-23	This point is halfway between the barrier wall and the MDEQ wells, to determine whether the toluene is moving away from the barrier wall.
MIP-24	To determine whether the toluene is moving away from the barrier wall and whether the screen intervals of MW-85B and MW-85C are appropriate for either of these wells to serve as a sentinel well.

Table 1. Reasoning for locations of proposed additional MIP borings.

3. *Section 2.3--the toluene concentrations are high enough to indicate it is part of a NAPL, which means it has some ability to move counter to the direction of groundwater flow.*

The concentrations may indicate LNAPL, or another source. However, at each sampling event, all wells are tested for LNAPL prior to sampling, and LNAPL has not been detected in any of the wells that were sampled, including PZ-111A. In addition, LNAPL was tested for and was not detected in PZ-111-VAS in October 2010. We will continue to check for LNAPL during future sampling events.

Figure 9 below shows the locations of previous borings that have been advanced at the site (particularly in the vicinity of PZ-111A), several of which included the determination of lithology from split-spoon samples. None of the boring logs indicate the presence of clay stringers that would trap the toluene approximately 30 feet below the water table surface and impede the upward vertical migration.

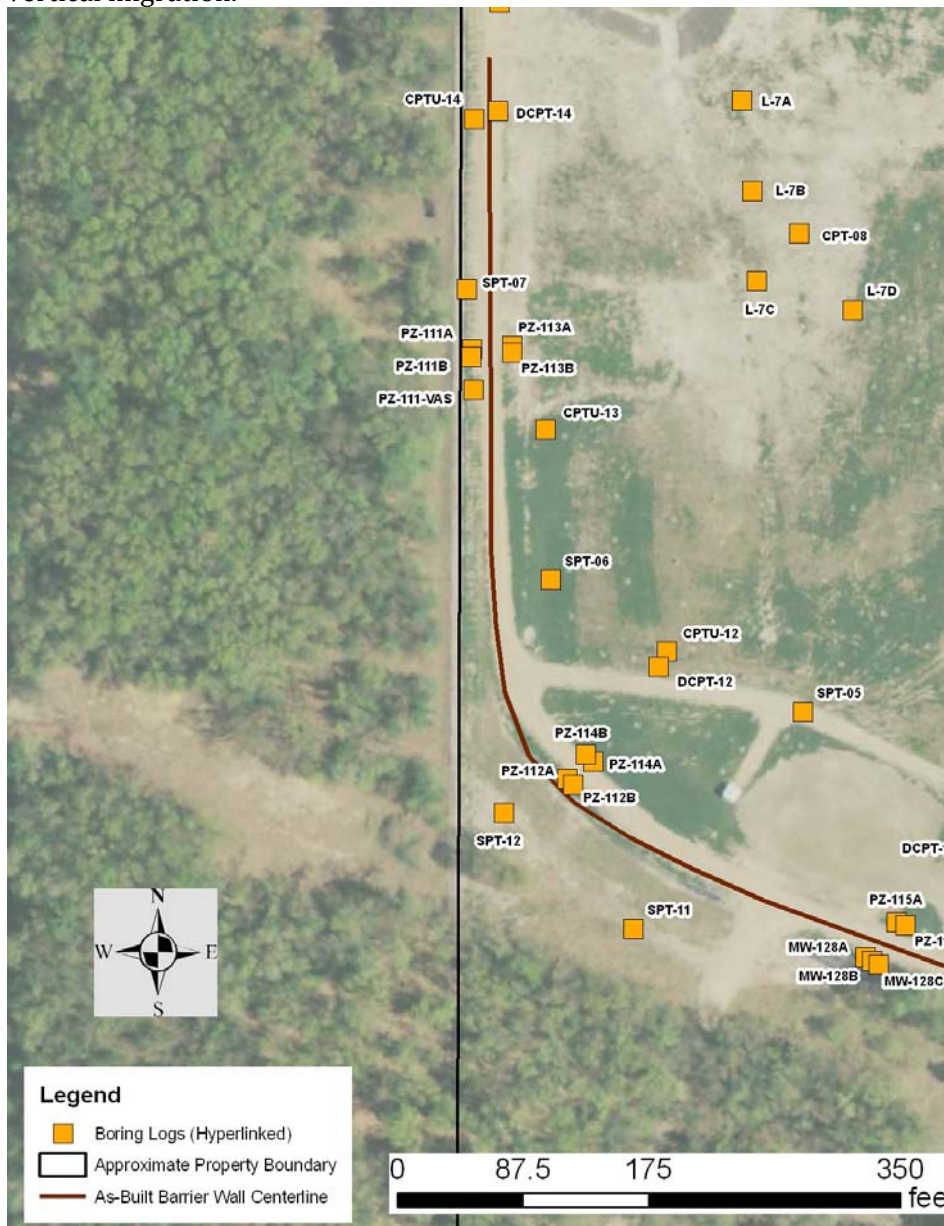


Figure 9. Locations where lithological logs exist.

August 17, 2011

4. *Section 3.2--suggest dye testing also be done at the interval with the highest toluene concentrations at each VAS. There is no guarantee the NAPL will be located at the water table--even though pure-phase toluene does have a density less than water.*

We agree with this comment and will collect split-spoon samples from VAS borings at the interval with the highest toluene concentration, as determined by the MIP results, and test the sample in the field with Sudan IV dye.

5. *[M]easuring for NAPL in wells PZ-111A and PZ-113A [should be done] at the start of the testing. As far as I can tell this has not been done.*

During interim sampling events, LNAPL is measured using an interface probe prior to sampling, when water levels are measured in the wells. In addition, monitoring wells PZ-111A, PZ-112A, PZ-113A, MW-128A, MW-128B, and MW-128C were measured for LNAPL with an interface probe during the resampling of MW-128B on August 11, 2010. LNAPL was not detected in any of the wells.

6. *SOP for Vertical Aquifer Sampling: It appears from this SOP that no lithologic information is to be collected. Is that accurate? Text indicates lithologic samples will be collected to at least the water table to allow for testing of NAPL. Lithology should be collected prior to VAS for the entire VAS interval.*

Based on the number of borings advanced at the site from which lithology data was collected and recorded (see Figure 9), the general lithology has been defined and specifically the area around PZ-111A has been defined. None of the boring logs indicate the presence of clay stringers that would trap the toluene approximately 30 feet below the water table surface and impede its upward vertical migration. The data acquired from the MIP borings (electronic conductivity (EC) logs that should show clay/silt versus sand) will also be useful in evaluating the soil profile. There may be areas where value-added data in the form of split-spoon sampling may be warranted (specifically west of PZ-111A), and those specific locations will be identified as part of the VAS review with the EPA which will follow the MIP work.

7. *Not sure why they want to measure water levels for low-flow sampling, but if they do they should try to key the reference point for each measurement to a common datum so that vertical gradient can be assessed.*

This SOP will be modified to specify that water levels will be taken during purging to ensure that drawdown does not exceed 0.3 feet, as requested below.

8. *I don't see an SOP 28 in this document, but I assume it's the same as the SOP for low-flow sampling from the monitoring wells described in the next SOP. If not, I need to see the actual SOP.*

This is an editing error. A corrected SOP will be issued including the other requested changes.

9. *SOP for Low Flow Monitoring Well Sampling: In Procedures, bullet 4, there is no in lieu of measuring all five parameters. All five parameters need to be measured. For the VAS we can remove stabilization criteria for turbidity.*

The SOP will be edited to remove the "in lieu of" statement and the stabilization criteria for turbidity.

10. *Take water levels during purging and ensure that drawdown does not exceed 0.3 feet. If it does, back down on the flow rate until you're within, and remain within, 0.3 feet of the hydrostatic water level.*

August 17, 2011

The SOP has been edited to state this (attached).



## **SOP for Low Flow Monitoring Well Purge and Sampling**

The objective in well sampling is to obtain a representative sample of the ground water from the formation where the well screen has been placed.

### **Job Description**

Obtain ground water samples from the specified monitoring wells using low flow sample collection rates.

### **Task-specific Equipment and Minimum Information Needed**

- detailed well location map
- order of the well sampling
- previous water level data
- disposable gloves
- total well depth data
- electric water level tape
- In-line multi-parameter water quality meter
- low flow (0.1 – 0.5 L/min) pump (bladder, peristaltic, electrical submersible, or gas driven pump and accessories)
- sample tubing (dedicated); Teflon if sampling for SVOCs
- sample bottles
- coolers and ice
- container for purge water (if required)
- well keys

### **Expectations**

- All water levels will be measured prior to sampling (see SOP for Water Level/Non-Aqueous Phase Liquid Level Measurement).
- All purge volume data will be recorded.
- Standard decontamination procedures (SOP for Field Decontamination) will be followed. Replace Teflon pump bladder if necessary.
- Noticeable discoloration or odor in the water will be reported.
- Each sample requested will be collected.

### **Procedures**

1. Uncap all the wells of a cluster to be sampled. Care must be taken not to mix the caps up. The caps should be placed near the well on a clean area, such as a small piece of plastic. Inspect the condition of the well(s).
2. If the cap is not vented, allow the well to vent to atmosphere until the water level has equilibrated (time required will vary). Take a round of water levels, measuring and

recording static water levels. (Do not measure total well depth until after all samples have been collected.)

3. Purge the well using a clean, decontaminated pump. Locate the pump intake in the middle or slightly above the middle of the well screen interval. Avoid disturbing the water column more than minimally during purging. Purge water is to be contained and transported to the groundwater treatment plant for disposal.
4. The amount of water to be purged prior to sampling will be determined by monitoring water quality parameters. Parameters to be measured using in-line flow cells are: pH, temperature, specific conductance, ORP and dissolved oxygen. The well shall be purged until the water quality parameters have stabilized. Pumping rate, drawdown, and the time or volume required to obtain stabilization of parameter readings can be used as a future guide to purge the well. Measurements should be taken every three to five minutes. Stabilization is achieved after all parameters have stabilized for three successive readings. Three successive readings should be within  $\pm 0.1$  for pH,  $\pm 3\%$  for conductivity,  $\pm 10$  mv for redox potential, and  $\pm 10\%$  for turbidity and DO. Stabilized purge indicator parameter trends are generally obvious and follow either an exponential or asymptotic change to stable values during purging. Dissolved oxygen usually requires the longest time for stabilization.
5. Record the amount of water actually purged and what was done with the purge water. Record the method of purging, and the pump used.
6. Collect the ground water sample with the pump at a rate not exceeding 500 ml/minute. VOCs are not to be sampled using a peristaltic pump.
7. Fill the sample container(s) accordingly.
8. Seal the container.
9. If the container is a VOC vial, fill the vial completely until a convex meniscus is formed at the top of the vial and cap quickly so that the vial contains no headspace. Turn the full container upside down and tap it lightly. Watch for air bubbles. If air is present in the bottle, discard and resample the well.
10. Label the sample bottle(s) and place in a cooler with ice for transport to the laboratory.
11. Follow standard decontamination procedures. Replace tubing used with the pump(s) after each use, and replace the short length of internal silicone tubing in the peristaltic pump after each use. Completely disassemble the bladder pump and carefully decontaminate after each use. Replace the Teflon bladder if necessary.

Reference: Puls, R. W. and Barcelona, M. J., 1996, "Low-Flow (minimal drawdown) Ground-water Sampling Procedures," Ground Water Issue, United States Environmental Protection Agency, EPA/540/S-95/504 April 1996.

## **SOP for Vertical Aquifer Sampling (VAS)**

### **Job Description**

VAS will be conducted using either a GeoProbe with a four-foot long well screen or a hollow-stem auger rig with a temporary monitoring well. Groundwater samples will be collected every eight feet from the water table down to the top of the till. The groundwater samples will be collected using low-flow procedures.

Several different methods can be used to advance and retract the sampling tools. The method used will be dependent on accessibility to the sample location and type of materials being sampled. Sampling equipment can be advanced and extracted using impact hammers, hydraulic force, winches or hand driven methods.

### **Task-specific Equipment and Minimum Information Needed**

- detailed well location map
- disposable gloves
- electric water level tape
- In-line multi-parameter water quality meter
- low flow (0.1 – 0.5 L/min), small diameter bladder pump and accessories
- sample tubing (dedicated); Teflon if sampling for SVOCs
- sample bottles
- cooler with ice to hold filled sample bottles
- container for purge water (if required)
- PID or FID for health and safety air monitoring

### **Procedures**

#### ***Pre-Sample Collection***

1. Locations of buried utilities will be checked and marked, as required by Michigan law;
2. The rig will be mobilized to the Site;
3. All sample collection equipment and supplies will be mobilized to the Site; and
4. Sampling equipment to be decontaminated per SOP for Field Decontamination.
5. Utilizing the appropriate PPE, drillers and technicians will mobilize to the sampling location;

#### ***VAS Groundwater Sampling using a GeoProbe***

1. Using clean sampling equipment, the drillers will advance standard “GeoProbe-type” sampling rods to the top of till. A milled, slotted screen will be attached to the first sampling rod advanced in each location.

2. After the rods are driven (by the GeoProbe rig) to the target depth, the rods will be lifted approximately four feet to expose the screen.
3. Groundwater samples will be collected using a small diameter, submersible bladder pump and the SOP for low flow monitoring well purge and sampling. All samples will be preserved and placed in cooler with ice as per that SOP.
4. Water levels will be measured during purging to ensure that drawdown does not exceed 0.3 feet.
5. Data on the purge water, including purge volume, discoloration, odors and PID or FID readings will be recorded.
6. The pump and tubing will be decontaminated using the SOP for field decontamination. Instead of decontamination, dedicated tubing can be used for each sample. The Teflon pump bladder will be replaced as necessary.
7. The GeoProbe rods will be retracted 8 feet (i.e., four feet above the top of the previous temporary well screen interval) and the process will be repeated until the water table is reached.

#### *VAS Sampling using a Hollow-Stem Auger Rig and Temporary Well*

1. Using clean sampling equipment, the drillers will advance hollow stem augers fitted at the bottom with a knockout plug to the top of till. A four-foot long, stainless steel well screen will be attached to a sufficient length of either galvanized pipe or black steel pipe to reach from approximately 3 feet above ground level to the bottom of the boring.
2. After the temporary well is placed, the augers will be retracted to above the water table. The well will be allowed to stabilize for a minimum of four hours before the first sample is collected.
3. Groundwater samples will be collected using the SOP for low flow monitoring well purge and sampling.
4. The temporary well will be withdrawn 8 feet (i.e., four feet above the top of the previous temporary well screen interval), and the process will be repeated until the water table is reached.

#### *Post-Sample Collection*

1. After sampling has been completed for the hole, a tremie pipe will be lowered to the bottom of the augers and the boring will be grouted with thick bentonite slurry.
2. The drilling equipment (GeoProbe rods, augers, temporary well screen and riser) will be removed and decontaminated.
3. The rig will then be mobilized to the next sampling location.
4. At the end of each workday, the samples will be submitted to the laboratory for analysis. The samples will be analyzed by the laboratory for VOCs (Method 8260) and low level benzidine and 3,3'-dichlorobenzidine (L.L. 8270C).